

INTEGRATED
Environmental Services, Inc.

Parcel C Groundwater Sampling and Analysis Plan

Boeing Realty Corporation
C-6 Facility
Los Angeles, California

January 18, 1999





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Prepared by
Integrated Environmental Services, Inc.

On behalf of
Boeing Reality Corporation



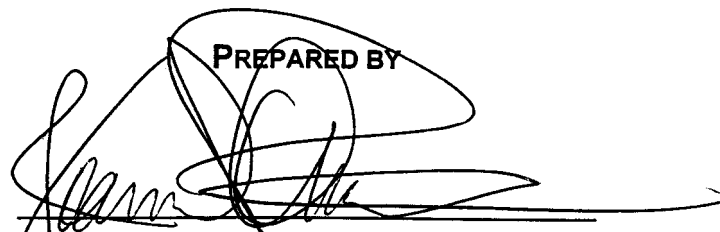
INTEGRATED
ENVIRONMENTAL SERVICES, INC.

SIGNATURES


PARCEL C GROUNDWATER SAMPLING AND ANALYSIS PLAN
BOEING REALTY CORPORATION C-6 FACILITY
LOS ANGELES, CALIFORNIA

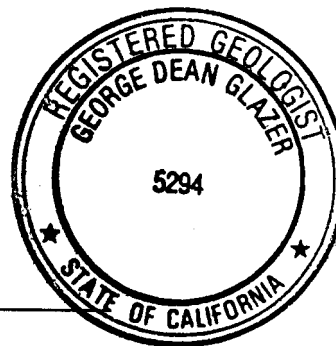
JANUARY 18, 1999

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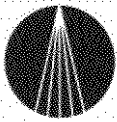
NOTICE

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ACRONYMS

ALCOA	Aluminum Company of America
BRC	Boeing Realty Corporation
Cal/EPA	California Environmental Protection Agency
COC	constituent of concern
CLP	Contract Laboratory Program
DAC	Douglas Aircraft Company
DCA	dichloroethane
DCE	dichloroethene
DOT	Department of Transportation
DQO	data quality objective
DTSC	Department of Toxic Substances Control
GC/MS	gas chromatography/mass spectography
ICP/GFAA	Inductively Coupled Plasma/Graphite Furnace Atomic Analyses
IDW	investigation-derived waste
IESI	Integrated Environmental Services, Inc.
ILM	International Light Metals
NPL	National Priorities List
NTU	nephelometric turbidity units
PCB	polychlorinated biphenyl
p-CBSA	para-chlorobenzene sulfonic acid
PID	photo-ionization detector
PLANCOR	U.S. War Department's Defense Plant Corporation
PPE	personal protective equipment
QA/QC	quality assurance/quality control
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
RWQCB	Regional Water Quality Control Board
SAP	Sampling and Analysis Plan
SVOC	semi-volatile organic compound
TCA	trichloroethane
TCE	trichloroethylene
TPH	total petroleum hydrocarbon
USCS	United Soil Classification System
VOC	volatile organic compound

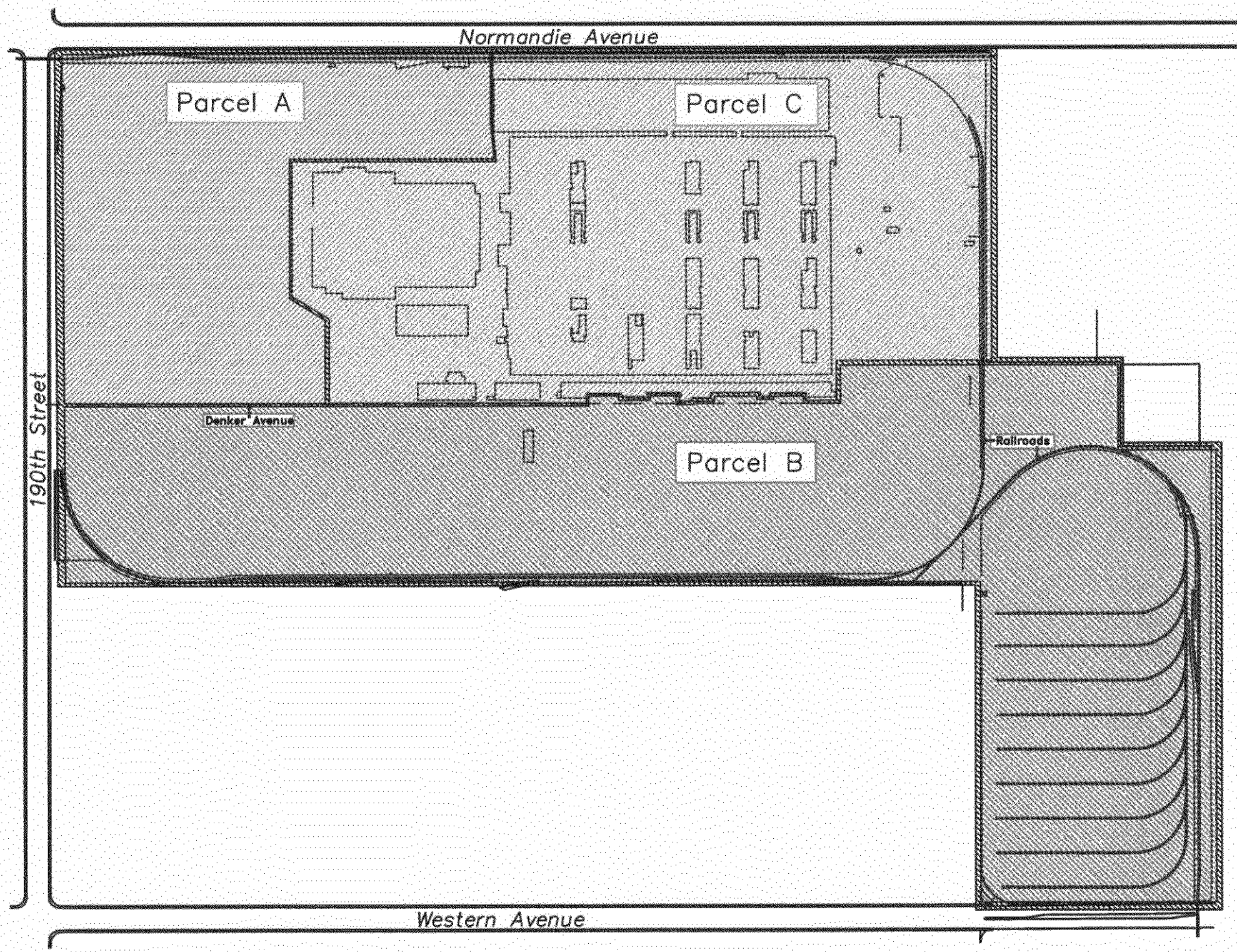
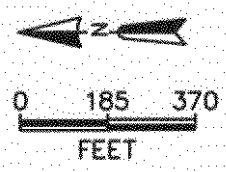


1. INTRODUCTION

The Boeing Realty Corporation C-6 facility in Los Angeles, California, is currently undergoing a phased redevelopment. The facility (Figure 1-1) has been used in the manufacture, storage and distribution of aircraft parts and components for over 45 years. Storage and distribution operations are still active in the southern half of the property, but the northeastern and western areas are being redeveloped for commercial use. As shown in Figure 1-2, the site has been divided into three parcels. Redevelopment of the northeastern portion of the property, Parcel A, began in 1996 and is nearly complete, while redevelopment of the western portion, Parcel B, is underway. The southern portion, Parcel C, will be redeveloped at a later date.



FIGURE 1-1
BOEING C-6 FACILITY AND VICINITY



 **INTEGRATED**
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TITLE:
**C-6 Parcel Delineation Map
Boeing C-6 Facility
Los Angeles, CA**

DWN: JDL
CHKD: JPO
DATE: 12-02-98

DES.: JDL
APPD: CBS
REV.: 1

PROJECT NO.:
BC6 C SAP
FIGURE NO.:
1-2



As part of the cleanup and redevelopment effort at the site, environmental samples have been collected and analyzed for constituents consistent with past and present site operations. Analytical results obtained from the sampling were used to identify areas that contain constituents at levels requiring removal and/or treatment. Impacts to soil and groundwater resulting from site operations have been identified.

Surface soils and groundwater are being remediated separately to expedite redevelopment of the site. Surface soils, defined as all soils to a depth of 12 feet below ground surface (bgs), are a concern due to their potential health impact to future site users and construction workers during redevelopment. Remediation of surface soils have been conducted prior to, or in conjunction with, redevelopment activities. Subsurface soils are being addressed with groundwater as they are not believed to pose significant health risk but may impact groundwater quality.

Between 1987 and 1998, a comprehensive groundwater characterization and monitoring program has been implemented in the Building 36 and 41 area at the C-6 facility. Results of the characterization indicate that the groundwater beneath the eastern portion of the facility has been impacted from site operations. This sampling and analysis plan (SAP) presents the approach, objectives, and procedures to further characterize groundwater beneath the eastern portion of the C-6 facility. Specifically, this SAP focuses on determining the nature and extent of groundwater contamination along the eastern, southern, and western boundaries of Parcel C.

This program has been developed to supplement previous groundwater investigations and provides procedures for collecting and analyzing subsurface soil and groundwater samples. Prior to the preparation of this document, available site records and photographs were reviewed to identify potential sources of contamination. Results of the review identified potential sources associated with operations within Parcel C.



1.1 SAMPLING OBJECTIVES

The overall objective of the proposed characterization is to determine the nature and extent of constituents of concern (COCs) in site groundwater and, more specifically, whether the COCs are related to former operations in Parcel C. The program includes limited soil sampling during the installation of wells. The data collected during the characterization will be used to confirm the presence or absence of COCs, determine the potential for off-site migration of COCs, and determine whether any COCs have migrated onto the site from off-site sources. The data will also be used to make decisions concerning possible remedial alternatives and will be incorporated into a site-specific health risk assessment at a later date.

To accomplish the objective of this program, Boeing has developed the following data quality objectives (DQOs):

1. Confirm and characterize the presence or absence of COCs in the soil and groundwater.
2. Determine the vertical extent of contamination in soil and groundwater.
3. Develop data resources sufficient for use in fate and transport modeling, to predict the movement and concentration over time of any COCs identified in the soil and groundwater.
4. Develop data resources sufficient for use in evaluating possible remedial action alternatives and in performing a site-specific health risk assessment for the site.

Several of these DQOs are interrelated, and data collection efforts can serve to meet more than one objective. Specific tasks have been developed to enable this study to meet each specific objective. This section discusses each of the program objectives and identifies the specific tasks needed to meet them.



1.1.1 Identify the Nature of COCs In Groundwater

As described in Section 2, investigations of the groundwater in this area indicate the presence of volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs). The presence of these constituents as well as the presence of total petroleum hydrocarbons (TPH), pesticides, and metals will be evaluated through the sampling and analysis of soil and groundwater.

1.1.2 Evaluate the Migration Potential of Contamination

In addition to characterizing the nature of COCs at the site, the extent of contamination within the Bellflower aquifer will be investigated. Soil and groundwater samples will be collected during this investigation effort. Soil samples will be collected at each well location prior to well installation. Soil samples will be evaluated to determine the presence or absence of COCs that have the potential to migrate to groundwater. Groundwater samples will be collected from these wells to determine the presence or absence of COCs detected in groundwater and to evaluate the potential for any on-site or off-site migration of groundwater constituents.

1.1.3 Determine the Fate and Transport of COCs in the Environment

Limited data have been generated concerning the long-term fate and transport of COCs from subsurface soils to the underlying aquifer. Data collected during this site characterization will supplement previously collected data, and the new, collective data set will be used in computer simulations to predict the movement and transformation of COCs migrating to and within the aquifer over time. This type of information will be used to predict future concentrations of COCs in the environment and to evaluate the potential for off-site migration of COCs. Fate and transport data will also be used to evaluate possible remedial alternatives if COCs are detected at levels requiring remedial action.



1.1.4 Develop Data Suitable for a Site-Specific Health Risk Assessment and Evaluation of Possible Remedial Alternatives

Data collected for the site must meet risk assessment data usability criteria to allow accurate evaluation of potential human health risks. This SAP provides the basis for collecting data of sufficient quality and scope for use in a site-specific health risk assessment and, if necessary, in the evaluation of possible remedial alternatives. Specifically, the procedures presented in this plan are intended to ensure that the data collected are comprehensive, consistent, reproducible, and representative of site conditions.

1.2 FACILITY DESCRIPTION AND HISTORY

As stated, the C-6 facility has been used for the manufacture, storage and distribution of aircraft parts and components for over 45 years. The property is located at 19503 South Normandie Avenue in Los Angeles, California, and is bordered by 190th Street to the north, Normandie Avenue to the east, 203rd Street to the south, and Western Avenue to the west (Figure 1-2). Developed from farmland in 1941 by the U.S. War Department's Defense Plant Corporation (PLANCOR), the property has been used for industrial purposes since that time. Table 1-1 presents a synopsis of the site's land use and ownership.

The major operators of the property have been the Aluminum Company of America (ALCOA), U.S. Navy, and Douglas Aircraft Company (DAC). All industrial use of the property occurred under their operation of the property. No fabrication operations have occurred at the site since 1992. Since that time, the operating portions of the property have been dedicated to the storage and distribution of aircraft parts as well as production-line material and tooling. Boeing Realty Corporation (formerly McDonnell Douglas Realty Company) became the site operator in August 1997, when its corporate parent, The Boeing Company, acquired McDonnell Douglas Corporation.



**TABLE 1-1
LAND-USE HISTORY**

Period	Land Use	Operator/Owner
Before 1941	Farmland	Various
1941-44	Aluminum reduction complex	ALCOA for Defense Plant Corp.
1944-48	Warehousing	War Assets Administration
1948-52	Warehousing	Columbia Steel Company
1952-70	Manufacture of aircraft parts	Douglas Aircraft Co. for U.S. Navy
1970-92	Manufacture/assembly of aircraft components	Douglas Aircraft Co.
1992-Pres.	Storage/distribution of aircraft spares, Storage of production-line material and tooling	Douglas Aircraft Co. for McDonnell Douglas (now Boeing)
1996-Pres.	Site investigation, demolition, remediation, and redevelopment	Boeing Realty Corp. (formerly McDonnell Douglas Realty Co.)

SOURCE: Boeing

1.3 SURROUNDING LAND USE

The surrounding area is characterized by a mixture of industrial, commercial, and residential land uses. Three National Priority List (NPL) Superfund sites, a California Superfund site, and a RCRA site border the C-6 property, while three other known hazardous-waste-impacted sites are within a half mile (Figure 1-3).

Several of the properties adjacent to C-6 have undergone extensive environmental investigation and are known to have contributed to the regional contamination of groundwater in the area. The more environmentally significant properties include the Montrose Chemical and Del Amo Superfund sites and the Lockheed Martin Corporation (Lockheed Martin) International Light Metals (ILM) site (Figure 1-3).

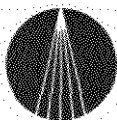


FIGURE 1-3
NEIGHBORING HAZARDOUS-WASTE-IMPACTED SITES

1.4 REGIONAL GEOLOGY AND HYDROGEOLOGY

Near-surface sediments underlying the site are assigned to the Lakewood formation, which includes essentially all of the upper Pleistocene sediments in the Los Angeles coastal plain. The Lakewood formation includes deposits of both marine and continental origin, representing stream transport and sedimentation along the Pleistocene marine plain. The Lakewood formation is underlain by the lower Pleistocene San Pedro formation, which continues to about 1,000 feet in depth in the area of the site (K/J 1997).

The Lakewood formation may include the Semiparched, Bellflower, and Gage aquifers in the area of the site. Major water-bearing zones within the San Pedro formation are the Lynwood and Silverado aquifers. The Silverado, at a depth of nearly 500 feet, is an important groundwater unit in the coastal plain and is considered a source of drinking water (K/J 1997).



Site groundwater conditions are known from previous investigations and the quarterly groundwater monitoring program (K/J 1997). The uppermost groundwater at the site appears to exhibit water-table conditions at depths of 60 to 70 feet. Regionally, this uppermost groundwater is considered part of the Semiperched aquifer and is separated from the deeper zones by the Bellflower aquiclude.

1.5 DOCUMENT ORGANIZATION

This SAP has been organized into six sections:

Section 1, *Introduction*, presents the purpose and organization of the report. The C-6 facility and operational history are also included.

Section 2, *Previous Groundwater Investigations*, summarizes the results of previous C-6 groundwater investigations pertinent to Parcel C.

Section 3, *Sampling Locations and Rationale*, identifies the potential on-site and off-site sources of the C-6 groundwater contamination and the proposed general well locations. Management of investigation-derived waste is also covered.

Section 4, *Sampling and Analysis Plan*, presents the sampling and analysis approach and procedures for collecting subsurface soil and groundwater samples. The types of field measurements to be made during the installation of groundwater monitoring wells and during the sampling of those wells are described, as are the quality assurance/quality control (QA/QC) procedures, sample handling and custody requirements, laboratory custody procedures, and documentation requirements.

Section 5, *Reporting and Schedule*, presents the timeline for major tasks and project deliverables.

Section 6, *References*, lists the literature cited in this plan.



2. PREVIOUS GROUNDWATER INVESTIGATIONS

Several groundwater investigations have been conducted at the C-6 site to identify potential on-site sources and define the nature and extent of groundwater contamination originating from on-site and off-site sources. This section summarizes the findings of these investigations. Figure 2-1 presents the areas investigated and the wells installed by each consultant.

2.1 SAMPLING RESULTS FROM THE WOODWARD-CLYDE WELLS

Woodward-Clyde & Associates installed 14 monitoring wells from 1987 to 1992 (Figure 2-1). Wells WCC-1S through WCC-12S were screened to no more than 90 feet, and wells WCC-1D and WCC-3D were screened from 120 to 140 feet. Groundwater from these 14 observation wells was sampled and analyzed each quarter from 1992 until 1997 when remediation and redevelopment activities commenced in Parcel A. Analysis of groundwater samples collected from the wells shows that the chlorinated compounds trichloroethene (TCE), dichloroethene (DCE), trichloroethane (TCA), dichloroethane (DCA), cis-1,2-DCE, and trans-1,2-DCE, as well as the aromatic compound toluene are present in shallow groundwater beneath the site (WCC 1987, JMM 1992, K/J 1997). Additionally, these compounds were found in subsurface soils.

Sampling results show that groundwater concentrations are highest near wells WCC-1S and -3S. Well 3-S is nearest the solvent tank cluster, and well 1-S is hydraulically downgradient (Figure 2-1). In addition, downgradient wells 6-S, 4-S, and 8-S have increasing or fairly constant concentrations of constituents of concern (COCs). These are the closest downgradient wells to Building 36, indicating the plume is centered in the vicinity of Building 36 and could possibly be slowly migrating east toward well 6-S, where the concentration of TCE has increased. At wells 12-S, 9-S, 5-S, 1-D, and 7-S, located further downgradient, the COC concentrations have decreased since the inception of sampling. The decrease is most likely the result of natural attenuation which is decreasing the size of the plume.



2.2 SAMPLING RESULTS FROM BOEING DAC-P1 WELL

An investigation of groundwater at the Lockheed Martin Corporation site has determined that volatile organic compounds (VOCs), total petroleum hydrocarbons (TPH), and metals have impacted the shallow groundwater beneath the Lockheed Martin property near the western border of the C-6 facility. Monitoring well DAC-P1, installed by Boeing at the boundary of the two properties, directly across from P-1, has been used to evaluate the quality of shallow groundwater entering the C-6 facility from upgradient sources. Groundwater samples collected from DAC-P1 have consistently contained high levels of TCE. The latest sampling data (from May 1997) show TCE at 15,000 ug/L (or parts per billion [ppb]) in groundwater at the border between the properties (K/J 1997). A review of sample data collected from DAC-P1 shows concentrations of TCE in groundwater at that location remain high but are decreasing (K/J 1997).

2.3 SAMPLING RESULTS FROM THE KENNEDY/JENKS TEMPORARY MONITORING WELLS

In June 1998, nine temporary monitoring wells were installed into the Semiperched aquifer in and adjacent to Buildings 1 and 2 in Parcel C. The purpose of this program was to obtain preliminary soil and groundwater information and assess the potential for impacts from former operations (see Section 3.1.1.2). No previous characterization activities have occurred in this area. A summary of findings from the temporary monitoring well program is provided below.

TPH-diesel and pesticides were not detected in any of the groundwater samples.

TPH-gasoline was detected in all groundwater samples at concentrations ranging from 0.2 to 3.5 mg/L. This analysis represents the total hydrocarbon mass per liter of water with molecular weight similar to the C4 through C12 alkanes. Thus, this could be a cumulative value for hydrocarbons and some chlorinated VOCs.

VOCs were detected in all of the groundwater samples. TCE and 1,1-DCE were the only two organic compounds occurring in all nine wells. The maximum detected concentrations of these



compounds occurred in TMW-2, with TCE at 34,000 ppb and 1,1-DCE at 36,000 ppb. These concentrations may be attributable to former solvent storage and distribution in Building 36.

Concentrations of these constituents decrease in the downgradient direction. It is not known at this time if these downgradient concentrations (i.e., TMW wells 8, 7, 4, and 6) are solely attributable to the suspected Building 36 source or represent the cumulative concentrations from Building 36 and other upgradient sources in the Building 1 and 2 area.

Bis(2-ethylhexyl)phthalate was the only SVOC detected in groundwater but was detected only in TMW-8 and TMW-9. This material is an industrial plasticizer with no known usage at the site. Furthermore, bis(2-ethylhexyl)phthalate is a common laboratory contaminant. Subsequent sampling of the temporary wells should determine whether this area is a source of this material.

2.4 SAMPLING RESULTS FROM MONTROSE CHEMICAL CORPORATION'S WELLS

The Montrose Chemical site is south of the C-6 facility and occupies approximately 13 acres. The site operated as a DDT-manufacturing plant from about 1947 until 1982 (see Section 3.1.2.2). In 1989, the property was added to the Superfund National Priorities List. As a result, numerous groundwater monitoring wells were installed on and adjacent to the Montrose property. Four of these wells (MW-08, MW-09, MW18, MW-19) are on the C-6 property.

Chloroform, chlorobenzene, and para-chlorobenzene sulfonic acid (p-CBSA) have all been detected in samples collected from Montrose well MW-09 (located on the C-6 facility, 300 feet south of Building 2). These wells were installed by Hargis and Associates, environmental consultants for Montrose, during their remedial investigation of the Montrose Chemical site.

A review of the Montrose data by Kennedy/Jenks indicates that Montrose is the source of the chloroform and chlorobenzene impacts in Montrose well MW-09. There are no known uses of either of these compounds at the C-6 facility (K/J 1991, K/J 1994). In addition, p-CBSA, a compound unique to DDT manufacture, was detected in groundwater samples collected from Montrose well MW-09 (K/J 1991).



3. SAMPLING LOCATIONS AND RATIONALE

Groundwater samples will be collected from monitoring wells installed at locations along the Parcel C boundary. Both soil and groundwater samples will be analyzed for the types of compounds related to the site's operating history—volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), total petroleum hydrocarbons (TPH), and metals. In addition, groundwater samples will be analyzed for pesticides as these compounds have been detected in groundwater to the south of the C-6 facility. The analytical data collected will be used to meet the objectives specified in Section 1.1.

3.1 POTENTIAL SOURCES OF GROUNDWATER CONTAMINATION

Based on data available from the previous investigations, the impacts to C-6 groundwater appear to have been caused by both on-site and off-site sources. On-site sources include those associated with former C-6 operations, and off-site sources include those associated with operations at adjacent or neighboring properties whose contaminants have migrated beneath the C-6 facility. A discussion of both on-site and off-site sources is presented in this section.

3.1.1 Potential On-Site Sources

Currently, three potential on-site sources of concern have been identified: the former Building 36, Buildings 1 and 2, and the former groundwater production wells. Each of these areas has been tentatively identified and sampled, but the extent of contamination associated with these areas is not clearly defined. The following summarizes the historical operations associated with each potential source. A summary of previous groundwater investigations at the C-6 facility is presented in Section 2.



3.1.1.1 Former Building 36

Building 36 was located along the southern edge of Parcel A, adjacent to the north-east corner of Building 1 (Figure 3-1). Building 36 was constructed in the 1940s by ALCOA (which referred to it as Building 62). This building was used to house pumps, but ALCOA engineering drawings do not reveal the type of product that was pumped. DAC converted this building into a paint and solvent storage area in the early 1950s and re-designated the structure.

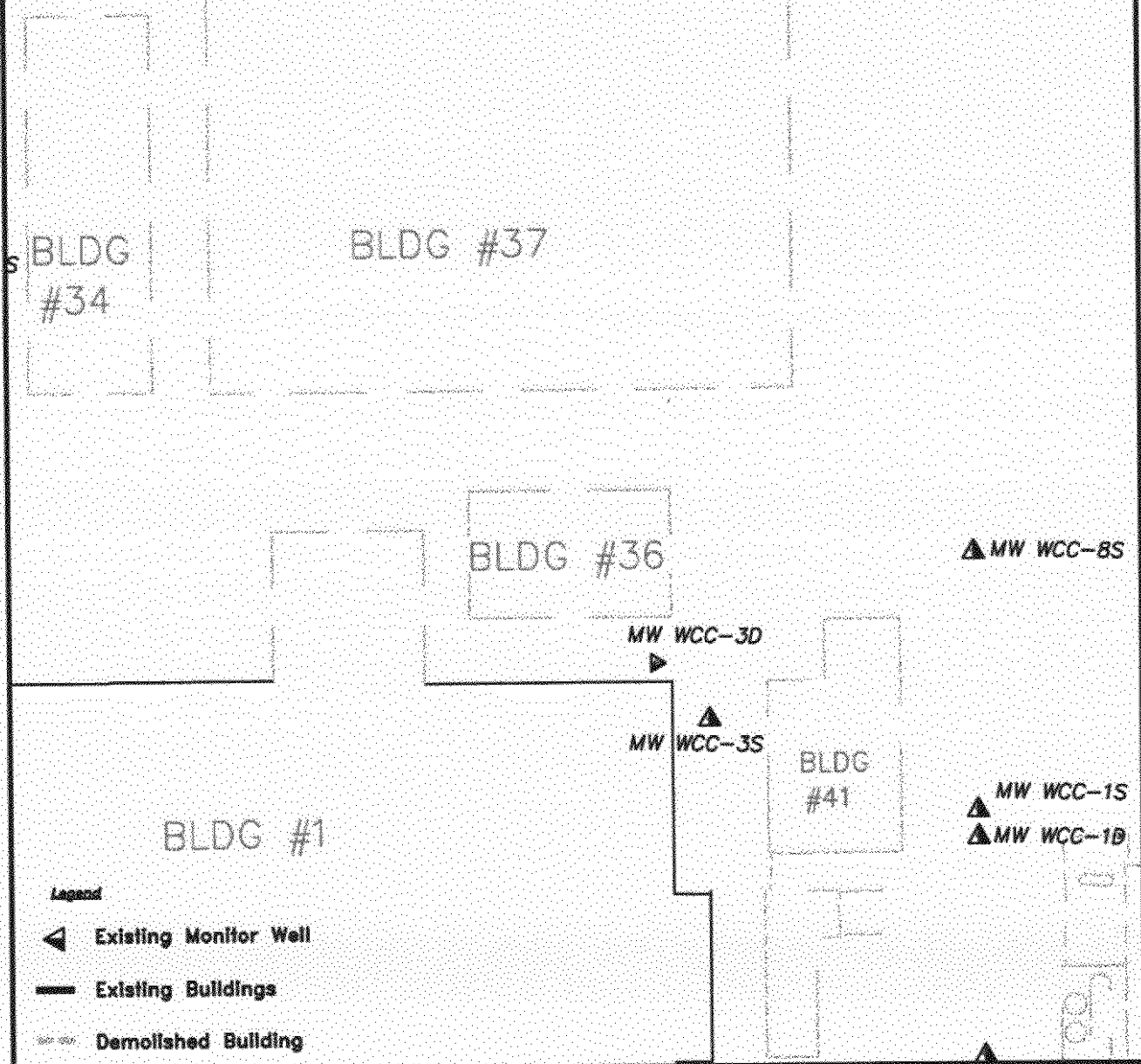
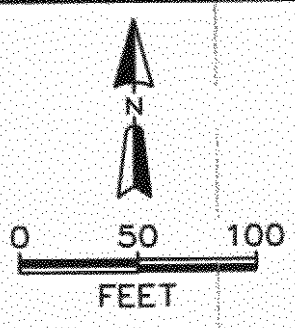
DAC drawings show a large array of interconnected solvent drums located along the interior southern wall of the building. These drums appear to have been connected to underground solvent storage tanks located between Building 36 and Building 2. Before being demolished, Building 36 was used to store used aircraft interiors. The date when paint and solvent storage operations ceased in Building 36 could not be determined from the drawings. It is believed that storage operations continued until approximately 1992, when manufacturing activities ceased.


In 1985, a site-wide underground tank management program was implemented at the C-6 facility. During the program, organic contamination was identified in the Building 36 soils. The contamination is believed to have resulted from leaks in tanks or piping associated with the solvent tank cluster south of Building 36 in Parcel A. Groundwater monitoring wells were installed to assess the potential impact to groundwater. Results of the groundwater sampling are summarized in Section 2.

3.1.1.2 Buildings 1 and 2

Buildings 1 and 2 occupy the majority of Parcel C (Figure 3-2). In the 1940s, ALCOA constructed several buildings in this area to house carbon baking and aluminum production operations. In the early 1950s, DAC consolidated several structures to form Buildings 1 and 2. Material storage is the current activity in these buildings.

F:\1\BldgMap.dwg



 INTEGRATED Environmental Services, Inc. 3880 Westlark Place, Suite 210 Newport Beach, CA 92660 (949) 852-9250	TITLE: Building 36 Location Map Boeing C-6 Facility Los Angeles, CA	DWN: JDL	DES: JDL	PROJECT NO.: BC6 C SAP
		CHKD: CBS	APPD: JFH	
		DATE: 12/04/98	REV: 1	FIGURE NO.: 3-1



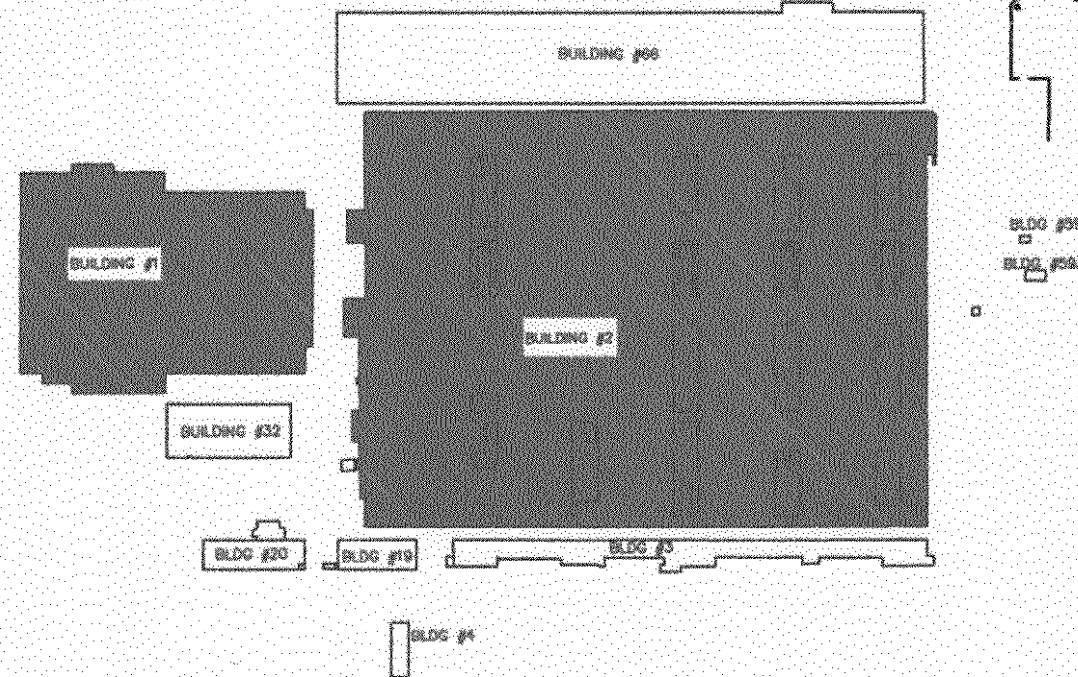
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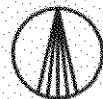
- Buildings 1 and 2
- Existing Buildings

190th Street

Normandie Avenue



Western Avenue



INTEGRATED
Environmental Services, Inc.
3990 Westerly Place, Suite 210
Newport Beach, CA 92660 (949) 852-9050

TITLE:

Building 1 & 2 Location Map
Boeing C-6 Facility
Los Angeles, CA

DWN: JDL	DES.: JDL	PROJECT NO.: BC6 C SAP
CHKD: JSB	APPD.: CBS	FIGURE NO.: 3-2
DATE: 12/04/98	REV.: 2	



In June 1998, approximately 35,000 operational and design drawings were located at the C-6 facility. Integrated Environmental Services, Inc. was contracted to conduct a full-scale review of potential environmental concerns identified in these drawings. Table 3-1 summarizes the potential contaminant sources associated with historical operations by both ALCOA and DAC in Buildings 1 and 2, as determined by the drawing review. Buildings 1 and 2 have been used extensively for solvent storage, milling, plating, painting, and degreasing—operations prone to environmental releases. Based on these findings, Boeing, under Regional Water Quality Control Board (RWQCB) oversight, installed nine temporary wells for a preliminary look into groundwater quality under Buildings 1 and 2.

3.1.1.3 Former Groundwater Production Wells

The presence of three deep production wells constructed in the mid-1940s and originally extending to a depth of 596 feet presented a potential pathway through which cross-contamination could occur. These deep wells, one located in Parcel A and two in Parcel C, were used to supply water during ALCOA operations and later for fire protection. These production wells were known as Owners Wells 1, 2, and 3. Figure 3-3 shows the location of the former production wells.

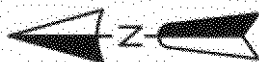
At the onset of the redevelopment project, Owners Wells 2 and 3 were still present. Well 1, however, could not be located and is believed destroyed. A review of historical, operational, and design drawings for the C-6 facility indicated that Well 1 was located at the current location of Building 20, in Parcel C. The location will be confirmed during the demolition of Building 20 once Parcel C redevelopment has begun.

In July 1998, Owners Wells 2 and 3 were destroyed in accordance with the Well Destruction Work Plan (RCS 1998a) and current California Department of Water Resources (DWR) well standards as outlined in DWR Bulletin 74-81 and its supplement, DWR Bulletin 74-90. Destruction operations at these wells are presented in the Destruction of Two Water-Supply Wells report (RCS 1998b).



TABLE 3-1
POTENTIAL CONTAMINANT SOURCES ASSOCIATED
WITH HISTORICAL OPERATIONS AT BUILDINGS 1 AND 2

Operator	Structure	Operations
<u>Building 1</u>		
ALCOA	Comprised of 6 buildings (No. 54, 54A, 55, 56, 58, and 60)	<ul style="list-style-type: none">• Carbon baking• Settling basin• Two fuel oil pump houses• Underground fuel storage tanks
DAC	Consolidated 6 of ALCOA's buildings into one structure (Building 1)	<ul style="list-style-type: none">• Coolant reclamation• Oil storage• Chemical milling• Titanium processing• Aluminum cleaning• Aluminum anodizing• Painting and paint stripping• Photo laboratory (basement)• Flow coat paint stripping and painting system (basement)
<u>Building 2</u>		
ALCOA	Comprised of 12 buildings (No. 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 32, and 34) and 9 ore storage areas (5, 7, 9, 11, 13, 15, 17, 19, and 21)	<ul style="list-style-type: none">• Ore melting to produce aluminum• Carbon rodding and metal servicing• Oil storage (outside southeast corner of building cluster)
DAC	Consolidated 12 of ALCOA's buildings and 9 ore storage areas into one structure (Bldg. 2)	<ul style="list-style-type: none">• Foundry• Chrome plating system• Cadmium plating system• Nickel plating system• Electro-polish system• Painting system and paint stripping• X-ray booths• Tar pit• Degreasing pits



0 50 100
FEET

BUILDING
#32

BLDG 29

Approximate Location
of Former
Production Well

Former
Production
Well

Former
Production
Well

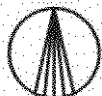
BLDG 58

BLDG #20

BL

Legend

- Buildings
- - - Demolished Buildings



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TITLE:
Location of Former Production Wells
Boeing C-6 Facility
Los Angeles, CA

DWN: JDL	DES.: JDL	PROJECT NO.: BC6 C SAP
CHKD: JPO	APPD: JSB	FIGURE NO.: 3-3
DATE: 12/04/98	REV.: 1	



Data collected from two monitoring wells installed on the C-6 facility indicate that groundwater in the deep Gage aquifer has not been impacted by the site groundwater contamination present in the Bellflower aquiclude. Furthermore, sediment samples were collected from the former production wells, Owners Wells 1 and 2, during abandonment. These samples showed no indication of contamination in the deeper aquifer sediments.

3.1.2 Potential Off-Site Sources

As mentioned in Section 1, the C-6 facility is located in an area of extensive groundwater contamination. The site is surrounded by three sites known to have contributed to the regional groundwater contamination: the Lockheed Martin site to the west, the Montrose Chemical Superfund site to the south, and the Del Amo Superfund site to the east. Below is a summary of the known nature and extent of groundwater contamination at these potential off-site sources.

3.1.2.1 Lockheed Martin Corporation

The Lockheed Martin site, located at 19200 South Western Avenue, is adjacent to and west of the C-6 facility (Figure 1-3 in Section 1). Industrial development of the property began in 1942 when an aluminum extrusion facility was constructed. Aluminum and titanium extrusion operations were conducted under numerous owners between 1942 and 1992. These operations reportedly produced wastes, including spent sulfuric, nitric, and hydrofluoric acids, spent sodium hydroxide, trichloroethane (TCA) and petroleum solvents, waste oils, acid/caustic sludges, aluminum dross, and polychlorinated biphenyls (PCBs) (K/J 1994). Based on the generated waste types, the site was subject to and operated in accordance with the Resource Conservation and Recovery Act (RCRA).

In 1992, the operations ceased and a RCRA Facilities Investigation (RFI) was initiated in accordance with RCRA site closure regulations. In 1994, Lockheed Martin initiated a remediation program to remediate contaminated soils. Since this time, structures at the site have been razed, surface soils remediated, No Further Action granted by DTSC, and redevelopment initiated.



Boeing has been informed that contaminated soils at the Lockheed Martin site have been remediated to levels protective of human health and groundwater at the site. However, an investigation of groundwater at the Lockheed Martin site conducted as part of the RFI determined that VOCs, TPH, and metals have impacted the shallow groundwater beneath the Lockheed Martin property near the western border of the C-6 facility.

No industrial operations have occurred on the western portion of the C-6 facility that could have contributed to groundwater contamination beneath Parcel B. The area has been used as a parking lot since ALCOA developed the site from farmland in the early 1940s (HMC 1993). Analysis of soil samples collected during characterization of Parcel B show no soil contamination within the parcel (K/J 1998; IESI 1998b).

A delineation of the Lockheed Martin plume beneath the C-6 facility has not yet begun. However, an investigation plan for groundwater beneath the western portion of the C-6 facility (Parcel B) has been jointly proposed by Boeing and Lockheed Martin to quantify the nature and extent of the Lockheed Martin plume (IESI 1998a).

An agreement between Lockheed Martin and Boeing has been reached in which Lockheed Martin has assumed financial responsibility for characterizing, delineating, and remediating the groundwater plume originating from the Lockheed Martin Site. The data obtained during the groundwater investigation will be used to develop and evaluate appropriate remedial alternatives (IESI 1998a).

The proposed investigation of the Lockheed Martin plume will be conducted in accordance with RFI sampling protocol. This approach is required by DTSC to maintain consistency in the Lockheed Martin database for RCRA closure of the Lockheed Martin property. The DTSC has assured Boeing that the sole purpose of the off-site groundwater investigation is to explore the migration of the Lockheed Martin plume and not to review the remediation conducted under the oversight of RWQCB at the C-6 site.



3.1.2.2 Montrose Superfund Site

The Montrose Chemical site is south of the C-6 facility and occupies approximately 13 acres. The site operated as a DDT-manufacturing plant from about 1947 until 1982. Between 1983 and 1985, the plant was dismantled and a temporary asphalt cover was placed over the property. Currently, the site remains vacant. In 1989, the Montrose site was added to the National Priorities List for the DDT contamination identified in soils, and chlorobenzene and parachlorobenzene sulfonic acid (p-CBSA) contamination identified in groundwater. P-CBSA is a waste product from the manufacture of DDT. This chemical has been detected in various aquifers down to depths of 300 feet bgs. According to the EPA, the plume is reported to have migrated off site for more than 1 mile. Montrose Chemical Corporation has been issued several orders from EPA since 1983 under the Superfund law.

3.1.2.3 Del Amo Superfund Site

The Del Amo site is east of the C-6 facility and occupies approximately 300 acres. From about 1942 until 1972, the site was operated as a synthetic rubber manufacturing plant. By 1993, shortly after operations ceased, the plant was decommissioned and the property was redeveloped into a business park. The former synthetic rubber plant consisted of three interrelated process plants: butadiene plant, styrene plant, and copolymer plant where butadiene and styrene were combined to produce synthetic rubber. Table 3-2 summarizes the primary feedstocks and chemicals used or produced within each process plant.

A waste pit area, consisting of four evaporation ponds and six waste pits, was operated in the southern portion of the Del Amo site. This area had once been used for disposal of synthetic rubber process residues (D&M 1996). Waste materials in the waste pits and ponds are characterized by high concentrations of aromatic VOCs, principally benzene and ethylbenzene, and PAHs, principally naphthalene (D&M 1996).



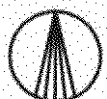
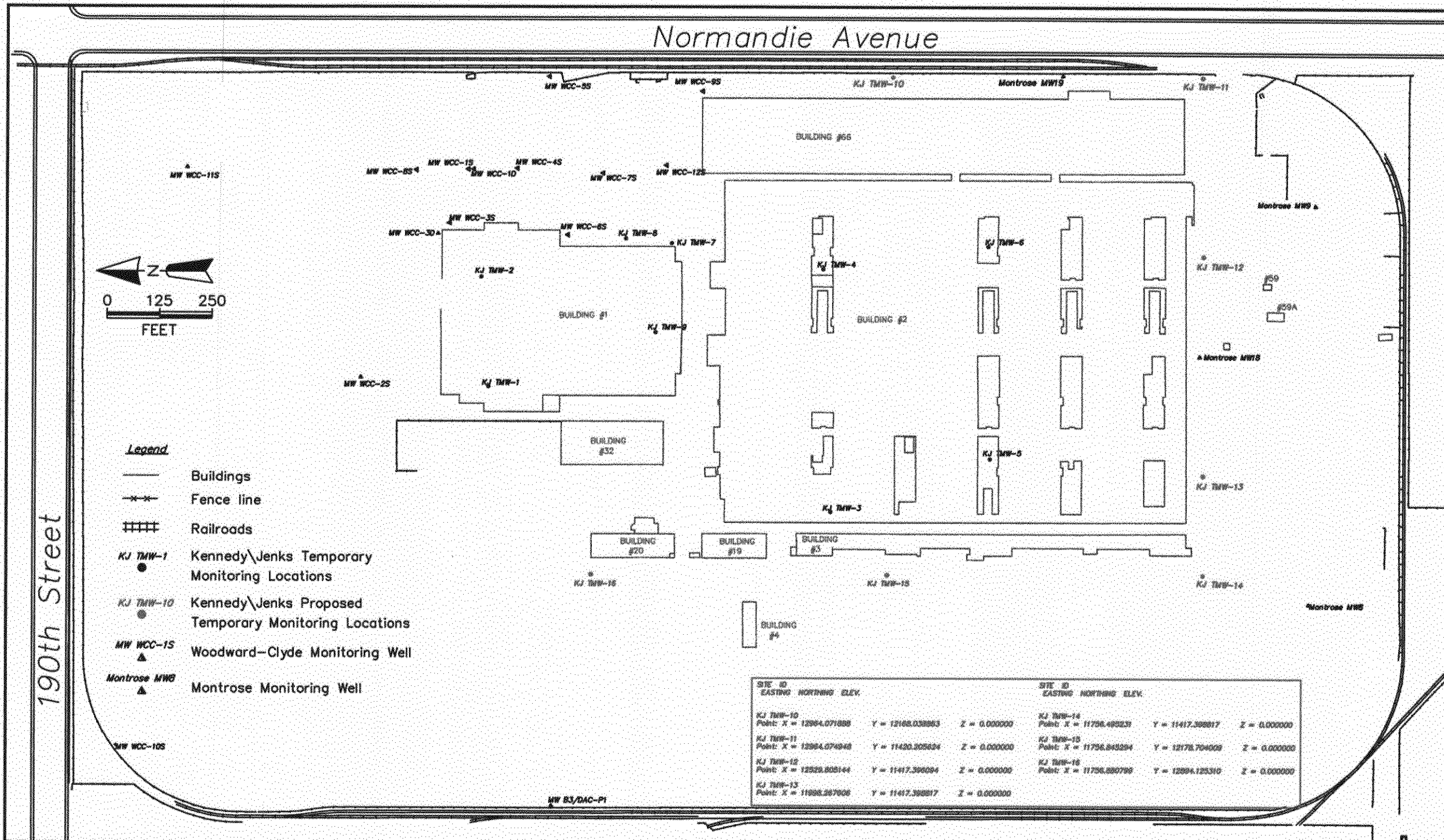
TABLE 3-2
SUMMARY OF PROCESS PLANTS AT THE DEL AMO SITE

Process Plant	Size and Location	Feedstocks	Chemicals used/ Produced in process	Major byproducts
Butadiene Plant	90 acres in the south-east portion	Butylene and butane	Absorption oil, acetic acid, acetone, ammonia, caustic soda, liquid chlorine, sulfuric acid, hydrated lime, soda ash, copper metal, and dehydrogenation catalyst	Waste gases, liquids, and oils
Styrene Plant	106 acres in the south-west portion	Propane and crude benzene	Toluene, ethylbenzene, styrene, caustic, hydrochloric acid, sulfuric acid, ethylchloride, aluminum chloride, iron-oxide catalyst, and tertiary butyl catechol	Heavy oils, tar, and coke
Copolymer Plant	80 acres in the northern portion	Styrene and butadiene	Cyclohexane, benzene, methanol, ajonedd (staining antioxidant), acosix (emulsifier), processing oils (naphthenic, aromatic and hyghly aromatic oils), and caustic solutions	Process wastewater

Source: D&M 1996

3.2 PROPOSED MONITORING WELL LOCATIONS

Placement of the groundwater monitoring wells will be along the western, southern, and eastern boundary of Parcel C (Figure 3-4) with all wells screened in the Bellflower aquiclude. Analysis of samples collected from these wells will provide the data needed to characterize the Bellflower aquiclude beneath the site. In addition, the analytical groundwater data will be used to determine whether contamination is migrating onto the C-6 property from off-site sources and whether off-site migration from the C-6 facility is occurring. The monitoring wells will be used to delineate the extent of the groundwater plume originating in Parcel C. Additionally, the monitoring wells installed along the western and southern Parcel C boundaries will be used to determine the quality of groundwater entering the site from off-site sources (Lockheed Martin and



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Proposed Monitoring Well Locations for the Parcel C Groundwater Investigation
Boeing C-6 Facility
Los Angeles, CA

DWN:

JDL

DES:

JPO

PROJECT NO.:

BC6 C SAP

CHKD:

CBS

APPD:

CBS

FIGURE NO.:

3-4

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4



Montrose/Del Amo, respectively), while the wells along the eastern boundary will be used to determine the quality of groundwater leaving the property.

3.3 WELL DESIGN AND INSTALLATION

Temporary wells will be installed during the investigation to confirm water levels and flow direction, the presence or absence of COCs, and the nature and concentration of contamination. The temporary wells will be completed and sampled prior to the strategic placement of permanent wells for long-term monitoring.

3.3.1 Monitoring Well Drilling and Installation

Seven temporary, 2-inch-diameter monitoring wells and two permanent, 4-inch-diameter monitoring wells will be installed during the groundwater investigation. Depending on field observations, an additional temporary monitoring well may be installed. Data obtained from the temporary wells will be used to determine placement of the permanent wells.

Drilling will be accomplished using 8-to-12-inch (outside diameter) hollow-stem augers. All soil collected will be described in the field by the contractor's geologist, acting under the supervision of a California Registered Geologist. Four boring locations (TMW-10, -12, -14, and -16) will be continuously logged. All field inspections and descriptions of soils will be completed on soil boring logs. The boring log will include lithologic descriptions in accordance with the Unified Soil Classification System (USCS), color descriptions according to the Munsell color chart, an identification number, the sample interval, blow counts, and other pertinent data for each borehole drilled.

Upon completion of the boring, groundwater monitoring wells will be installed. The wells will be constructed using threaded, 2-inch-diameter (temporary wells) or 4-inch-diameter (permanent wells), Schedule 40, flush-jointed, polyvinyl chloride (PVC) casing. Each well will be constructed with a single slotted interval with 15 feet of screen extending below the estimated groundwater surface.



The wells will be designed with provisions for a sand pack and cement/bentonite casing seal above the screen interval to prevent infiltration of surface water. The slot size and sand filter pack configuration will be based on the location-specific analysis of grain size. The blank and slotted casing will be assembled above ground and lowered into the boring through the center of the hollow-stem augers to the proper depth. No grease, oil, or glue will be used when joining the sections together. Clean silica sand (compatible with the slot size) will then be added as the augers are retracted from the borings. Depth soundings will be taken regularly to ensure that heaving conditions or sand bridging are not occurring and that the level of the introduced sand pack remains just above the lower extent of the augers being removed from the borehole. The process will continue until the sand pack extends 2 to 4 feet above the top of the slotted casing.

Following placement of the sand filter pack, the well will be surged using the appropriate diameter surge block. This will facilitate additional settling of the sand filter pack. Surging will consist of lowering the surge block to the bottom of the well and then raising and lowering the block along the entire length of the saturated screened interval. During surging operations, depth soundings will be taken regularly to determine whether additional sand will be necessary. Once surging is complete, bentonite pellets, chips, or slurry (depending on site conditions) will be added to the annular space above the sand pack. Potable water will be used to hydrate the bentonite. The amount of water added will be noted on the boring log. The bentonite seal will be at least 2 feet thick. The remaining annular space will be grouted approximately one foot below the surface with a bentonite and/or cement grout.

The PVC casing in each well will be capped with a PVC slip cap. The well heads will be protected by a traffic-rated, watertight box installed approximately 1 inch above ground surface. An earthen pad, sloped to route surface-water runoff away from the monitoring well, will be constructed around the well box.

Following sampling and analysis activities, the temporary wells will be abandoned by pressure grouting and over-drilling the top 12 feet of well casing.



3.3.2 Monitoring Well Development

Monitoring wells will be developed no sooner than 48 hours after the well installation has been completed. Groundwater levels and the total depth of the wells will be measured prior to and after the completion of development. Groundwater will be removed from the monitoring wells using a stainless-steel bailer followed by a centrifugal pump. Each well will be developed by removing a minimum of 3 well-casing volumes of water or, in the event of a well slotted in a low permeability zone, by bailing the well dry twice. If water is used during drilling, at least 3 times the volume of fluid injected into the formation during the drilling shall be removed in addition to the standard 3 well-casing volumes. Development water from each monitoring well installed during this investigation will be stored and sealed in U.S. Department of Transportation (DOT) approved 55-gallon drums. All drums will be labeled appropriately and retained on site, pending analysis and subsequent treatment and/or disposal by the contractor.

Field measurements of pH, temperature, specific conductance, and turbidity will be obtained at regular intervals (after each well volume at a minimum) throughout well development and will be recorded on a field data sheet (see Section 4.2). Best efforts will be made to develop the wells until groundwater becomes devoid of sediment, and pH and specific conductance measurements stabilize. The field parameters will be considered stabilized when two successive measurements are obtained (see Section 4.2).

3.4 UTILITY SURVEY

Prior to drilling, the contractor will notify the appropriate entities, including the Boeing Douglas Products Division personnel, to confirm the presence or absence of underground utilities near the boring locations. In addition, each borehole will be hand-augered to approximately 5 feet bgs to check the location for unmarked lines or utilities.



3.5 LAND SURVEY

Newly installed monitoring wells will be surveyed for location and elevation. The northing/easting coordinates of the well or boring location will be surveyed by a licensed surveyor to within 0.1 feet (plus or minus). Elevations at each well location will be surveyed relative to mean sea level to an accuracy of 0.01 feet (plus or minus). For monitoring wells, surveyor reference marks will be added to both the well casing and outer protective casing. The permanent mark on the well casing will be used as the reference point for water-level measurements. Survey information will be documented on survey forms, the master surveyed site plan, and in a computer database format.

3.6 MANAGEMENT OF INVESTIGATION-DERIVED WASTE

Investigation-derived waste (IDW) generated during the site investigation activities will consist of soil cuttings, well development water, decontamination water, and discarded personal protective equipment (PPE). Following completion of the field activities, disposal options will be recommended based on the findings of the investigation.



4. SAMPLING AND ANALYSIS PLAN

This section presents the sampling and analysis approach and procedures for collecting subsurface soil and groundwater samples. The types of field measurements to be made during the installation of groundwater monitoring wells and during the sampling of those wells are described, as are the quality assurance/quality control (QA/QC) procedures, sample handling and custody requirements, laboratory custody procedures, and documentation requirements.

4.1 SAMPLING PROCEDURES AND EQUIPMENT

Subsurface soil and groundwater samples will be collected and analyzed during this investigation. The sampling procedures and equipment to be used are presented below.

4.1.1 Soil Sampling

Subsurface soil samples will be collected at each of the monitoring well locations and submitted to a certified laboratory for analysis. The results of the analysis will be used to determine the nature of contamination in the subsurface soil as well as the vertical extent of contamination. Subsurface soil samples will be analyzed for:

- VOCs per EPA Method 8260
- SVOCs per EPA Method 8270
- TPH per EPA Method 8015 (diesel and gas)
- Pesticides per EPA Method 8080
- Title 22 metals per EPA Method 6010/7471/7196

Subsurface soil samples will be collected beginning at 1 foot bgs and then at nominal depths of 5, 10, 20, 30, 40, and 50 feet bgs, and at the capillary fringe. Total depth of each boring will be



based on the water level encountered. Borings will be continued to about 20 feet below the water table.

All soil samples will be collected by a split-spoon sampler using three 6-inch stainless-steel liners. The middle liner will be used for field screening and testing purposes, while the bottom liner will be sealed at both ends with plastic caps for submittal to the laboratory. A sample label will be affixed to each sample liner indicating the information defined in Section 4.6.1.

During soil sampling, the organic vapors in the soil will be measured using a photoionization detector (see Section 4.2.3).

4.1.2 Groundwater Sampling

Groundwater monitoring wells will be installed along the western, southern, and eastern boundary of Parcel C at the locations shown on Figure 3-4 (Section 3). Groundwater samples will be collected from each of the wells and submitted to a certified laboratory for analysis. The sample data returned from the laboratory will be used to determine the nature and extent of contamination in groundwater. Groundwater samples will be analyzed for:

- VOCs per EPA Method 8260
- TPH per EPA Method 8015 (diesel and gas)
- SVOCs per EPA Method 8270
- Pesticides per EPA Method 8080
- Title 22 metals per EPA Method 6010/7471/7196

The samples will be collected in the order listed above, which is representative of decreasing volatility. The samples for metals analysis will be filtered in the field using 0.45-micron membrane filters.



All monitoring wells will be purged prior to sample collection. The following procedures will be used:

1. Remove the well cap, and check for VOCs in the headspace using a PID. Record the reading in the Daily Field Measurement Record.
2. Measure the static water level and total depth of all wells prior to collecting groundwater samples. If more than 24 hours have elapsed since water levels were collected, recheck the static water level prior to purging. Record the depths in the Daily Field Measurement Record.
3. Calculate the volume of water in the well using the following equation:

$$V = C_f \pi r^2 h$$

where

- V = well volume (L)
- r = well radius (m)
- h = column of water in the well (total depth - depth to water) (m)
- C_f = 1,000 L/m³

To convert a well volume from liters to gallons, multiply V by the conversion factor 0.264 gal/L.

4. Purge water from the well until conditions described in item 5, below, have been met. Water may be removed from the well using a bailer, submersible pump, surficial suction pump, or bladder pump. Criteria for selecting the proper device for purging the well are presented below. The use of a pump is the preferred evacuation method; bailers will only be used if it is not possible to use a pump.
 - a. Bailers are most applicable for sampling after purging and for purging small-diameter, low-yield wells. If a bailer is used, it should be dedicated to the well, i.e., used only for that well. Field decontamination of bailers is not permitted.
 - b. Submersible pumps are most effective for wells that recharge quickly and where water levels are greater than 20 feet bgs. When a submersible pump is used, the pump will be slowly lowered into the well on a polypropylene safety line. Once the pump has been lowered to the desired level, the safety line will be secured. The submersible



- pump must be decontaminated between wells by washing the outside surfaces with tap water and a nonphosphate detergent, rinsing it with tap water, placing the pump in a container and pumping 20 gallons of potable water through it, and then rinsing again with distilled/deionized water. New drinking-water-grade polyethylene tubing will be used at each well where the submersible pump is employed for purging.
- c. The surficial suction pump can only be used if the water level in the well is not lower than 20 to 22 feet bgs. Dedicated intake tubing should be used for each well. New linear polyethylene tubing that conforms to the ASTM drinking-water-grade specifications will be used as the intake line. The intake line is discarded after every use.
 - d. The bladder pump typically will purge the well at a rate of 1 to 2 gallons per minute. The pump can be used for any size well if the volume of water in the well will not require an excessively long pumping time. New drinking-water-grade polyethylene tubing should be used as the discharge line. The pump will be dismantled and decontaminated prior to each use.
5. Measure the pH, conductivity, and temperature after each well volume has been purged to determine stabilization. Purging will be completed when three well volumes have been removed or when two successive measurements of specific conductance, pH, and temperature show variances within the following ranges:
- a. Specific conductance: ± 10 $\mu\text{mhos/cm}$ for the 0 to 800 range or $+ 50$ $\mu\text{mhos/cm}$ at the 800 to 1000 range
 - b. pH: ± 0.1 pH units
 - c. Temperature: $\pm 0.5^\circ\text{C}$
 - d. Turbidity: ≤ 50 NTU
6. Record the stabilization results on the Daily Field Measurement Record. Wells that recover very slowly should be purged at a rate of less than 1 gallon per minute. If the well is purged to near dryness using this slow rate, allow it to recover before collecting a sample.

Samples will be collected using disposable Teflon bailers and polypropylene rope, which will be used to lower the bailer into the well. New bailers and rope will be used at each well location.



Care will be taken to ensure that bailers and rope do not come into contact with any contaminated surface.

Samples will be carefully transferred into appropriate laboratory-provided containers, avoiding agitation or turbulence, which can result in the loss of VOCs. A sample label will be affixed to each sample container indicating the information defined in Section 4.6.1

4.2 FIELD ANALYSIS AND MEASUREMENTS

Field data will be collected during the installation of groundwater monitoring wells and during groundwater sampling activities. The types of field data to be collected at the site include:

- Water-level measurements
- Conductivity, temperature, pH measurements, and turbidity
- HNu photoionization detection

The field measurements will be considered stabilized when two successive measurements are obtained. The methods presented below are intended to ensure that field measurements are consistent and reproducible when performed by various individuals. Field personnel will record the measurements on standardized Daily Field Measurement Record as described in Section 4.8.1.

4.2.1 Water-Level Measurements

Depth-to-water and total well-depth measurements will be made prior to well purging. Water levels may be measured using a steel tape, electric probe, and/or pressure transducer. In general, to determine hydraulic gradients, and in some permeability or aquifer tests, water levels will be measured with an electric probe or transducer. In completed wells, water levels will be measured from a permanently marked reference point on the well casing. The elevation of this point will be



established by survey as described in Section 3.5. Water-level measurements will be made and recorded in the Daily Field Measurement Record to the nearest 0.01 foot.

4.2.2 Conductivity, Temperature, pH, and Turbidity Measurements

Specific conductance, water temperature, pH, and turbidity measurements will be made in the field during purging and before and after each groundwater sample collection. The water sample will be placed in a sample container solely for field testing. A field pH meter with a combination electrode or equivalent will be used. Temperature measurements will be performed using standard thermometers or equivalent meters. Combination instruments capable of measuring two or more of the parameters may also be used.

All instruments will be calibrated as described in their manuals. If conductivity standards or pH buffers are used in field calibration, their values will be recorded on the Daily Field Measurement Record. All probes will be thoroughly cleaned and rinsed with distilled water prior to conducting any measurements.

4.2.3 HNu Photoionization Detector

The HNu photoionization detector (PID) will be used for measuring gaseous levels of a variety of organic compounds. The PID is a portable, nonspecific, vapor/gas detector which will be calibrated using isobutylene. Isobutylene provides a mid-range response for most constituents of interest, is relatively safe to use, and is readily available. The PID contains an ultraviolet light source within its sensor chamber. Ambient air is drawn into the chamber. If the ionization potential of any molecule present in the ambient air is equal to or lower than the energy of the ultraviolet light source, ionization will take place, causing a deflection in the meter.

The PID will be used to monitor the organic vapors in soil. A soil sample will be placed into a sealed polyethylene bag for 5 to 10 minutes to allow organic constituents to volatilize. The PID probe will be inserted into the bag to measure the headspace in the bag. A qualitative measure of



the organic vapors in soils will be recorded. The PID will also be used to monitor the soil cuttings and to measure organic vapors in the headspace of monitoring wells after the cap has been removed and prior to sampling. All readings will be reported in parts per million and recorded in the Daily Field Measurement Record.

4.3 EQUIPMENT DECONTAMINATION PROCEDURES

All materials and equipment that come into contact with potentially contaminated soil, drilling fluid, or water will be decontaminated prior to and after each use. Decontamination of equipment will prevent or minimize cross contamination in samples and sampled media, which is important for preventing the introduction of error into sampling results and for protecting the health and safety of site personnel. Decontamination will consist of steam cleaning or a nonphosphate detergent scrub, followed by fresh-water and distilled-water rinses. After materials and equipment are decontaminated, they will be stored on clean plastic sheeting in an uncontaminated area. The following decontamination procedures will be used for sampling materials and equipment:

- Drill rigs, augers, drill rods and any other equipment placed in the hole during drilling will be steam cleaned prior to use and between borings. Visible soil and grease will be removed with a stiff brush prior to steam cleaning.
- Soil samplers (i.e., split spoons) will be cleaned prior to initial use and between uses, either by steam cleaning or as follows:
 - Nonphosphate detergent wash
 - Tap-water rinse
 - Distilled-water rinse (two to three times)

4.4 CALIBRATION PROCEDURES

Calibration is the process of adjusting an instrument response to match that of a known reference standard. These procedures ensure the operator that the instrument is operating properly and will generate reliable data. Procedures described in this section pertain to the calibration of equipment



and instrumentation in the field and laboratory. All calibrations for field and laboratory equipment will be recorded in appropriate field notebooks.

Devices shall be calibrated and adjusted at specified intervals using appropriate equipment and material (e.g., calibrated gases). All equipment will be checked daily and recalibrated when the variance between the reference standard and instrument readout exceeds 10 percent (plus or minus), or a smaller percentage if suggested by the manufacturer. Instruments will be recalibrated anytime they are subjected to conditions outside the range of normal use or anytime field personnel suspect the calibration has been altered. Instruments will be recalibrated prior to use after they have been subjected to a sudden impact (e.g., from being dropped or mishandled), or after significant changes in temperature or humidity, or when their batteries have been depleted. The user is responsible for operating and calibrating equipment in the proper manner. The following procedures will be followed for field-calibrated equipment:

- A list of the instruments to be calibrated and their frequencies of calibration will be maintained. The method and interval of calibration shall be based on the instrument's stability characteristics, required accuracy, and other conditions affecting measurement control.
- The range, type, and accuracy of the instruments in use shall be appropriate for the tests being performed.
- A master calibration file will be maintained for each instrument and will include, at a minimum, the following information:
 - Name of instrument and model number
 - Serial and/or identification number
 - Frequency of calibration
 - Date of last calibration
 - Name of party performing last calibration
 - Due date for next calibration
 - Identification of the calibration gas or solution
- Instruments will be marked with calibration due dates whenever possible. When this is not possible, alternative methods of tracing the device to its calibration date shall be employed.



Field equipment which will require calibration include instruments for measuring organic vapor content, water levels, pH, conductivity, and temperature. The field equipment, calibration procedures, and precision requirements are presented in Table 4-1.

4.5 QUALITY ASSURANCE SAMPLES

Standard laboratory QA/QC procedures will be followed to ensure the quality of the analytical results obtained from all samples. In addition, the following types of QA/QC samples will be collected and analyzed: trip blanks, field blanks, equipment rinsates, and field duplicates.

TABLE 4-1
FIELD EQUIPMENT CALIBRATION

Field Measurement	Equipment	Calibration Procedure	Precision
Organic vapor content	PID	Calibrated against isobutylene in zero air	100 ppm
Water level survey	Electrical water probe	Reference to steel tape	0.01 ft
	Steel tape	Reference to new tape	0.01 ft
Water pH	pH meter	2-point buffer solution	0.1 pH unit
Specific conductance	Conductivity meter	KCl reference solution	$\pm 10 \mu\text{mhos/cm}$ for 0-800 range ($+50 \mu\text{mhos/cm}$ for 800-1000 range)
Turbidity	Turbidity meter	Reference to instrument manual	$\leq 50 \text{ NTU}$
Water temperature	Thermometer	Factory calibrated	

PID = Photoionization detector
NTU = Nephelometric turbidity units



4.6.1 Sample Identification and Labeling

Each sample collected at the C-6 facility will be assigned a unique sample identification number to distinguish it from all other samples. This identification number will be used on all documentation relating to collection, handling, analysis, and reporting of the analytical results of each individual sample. Since samples will typically be analyzed for a number of different chemical constituents that require different sample containers and preservation techniques, the same sample identification number will be assigned to each portion of the original sample split among the individual sample containers.

The nomenclature to be used in assigning sample identification numbers is as follows:

loc-md-y-d

where

- loc* = location from which the sample was collected (soil boring or well number, e.g., SB1, MW1)
- md* = type of media sampled (SB for subsurface soil, GW for groundwater)
- y* = sample number for boring identification (sequentially numbered samples collected from each boring, e.g., 1, 2, 3)
- d* = depth in feet at which the sample was collected (subsurface soil samples only)

Duplicate samples will be assigned the same number as the original with a "D" following to indicate "duplicate."

QA/QC samples will be consecutively numbered using the following nomenclature:

- Trip Blank-#
- Rinsate-#

A sample label provided by the laboratory will be affixed to each individual sample container. Information recorded on the label will be printed in indelible ink. The label on all samples collected during the site investigation will contain the following information:

- Project name and location



Rinsate Blanks

The equipment rinsate samples will be collected by pouring analyte-free water over and through the sample collection equipment after the equipment's final decontamination rinse. The rinsate samples will be analyzed for the same parameters applied to the samples collected using each particular sampling method (e.g., split spoon or hand auger). The results of the equipment rinsate are used to determine whether equipment decontamination was effective. One rinsate blank will be collected during the groundwater investigation. The rinsate blanks will be analyzed for:

- VOCs per EPA Method 8260
- TPH per EPA Method 8015
- SVOCs per EPA Method 8270
- Pesticides per EPA Method 8080
- Title 22 metals per EPA Method 6010/7471/7196

Field Duplicate Samples

Field duplicate soil samples will be collected from adjacent liner (stainless-steel sleeve) locations. A duplicate water sample will be collected from a well at the same time that the original sample is collected. The duplicate samples will be analyzed for the same parameters applied to their associated original samples. The results of the field duplicate samples are used to evaluate the entire sample measurement system.

4.6 SAMPLE HANDLING AND CUSTODY

All samples will be handled according to the procedures contained or referenced in this section. Specifications for sample labeling and sample container and preservation measurements are presented below. Field logs and sample custody forms will also be maintained.



Collection and analyses of trip blanks, field blanks, equipment rinsates, and field duplicates are intended as QA/QC checks on the representativeness of the samples collected, the precision of sample collection and handling procedures, and the thoroughness of the field equipment decontamination procedures between sampling events. A sampling event is considered to start when the sampling personnel arrive at the site and end when these personnel leave for more than one week.

Trip blanks and equipment rinsates are prepared using analyte-free water and sample containers. All blanks will be handled and analyzed in the same manner as samples collected from the site.

Trip Blanks

Trip blanks are samples that originate at the laboratory, are transported to the sampling site, and then returned to the laboratory with site samples to be analyzed for VOCs. Trip blanks will be placed in sample coolers before being sent to the site so they will accompany the samples throughout the sample collection, handling, and transport process. The results of the trip blank analyses are used to determine whether samples have been contaminated by VOCs during sample handling and transport to the laboratory. The trip blanks will be analyzed for VOCs per EPA Method 8260.

Field Blanks

Field blank samples will be collected from each source water (e.g., distilled water, steam cleaning water) used to decontaminated field equipment. Field blanks will be analyzed for the same parameters as will the samples collected when the water sources are being used for decontamination. The results of the field blanks will be used to assess whether wash or rinse water contained contaminants that may have been carried over into the site samples.



- Project number
- Sample location
- Sample identification number
- Date and time of collection
- Name or initials of the individual collecting the sample
- Analyses to be performed on the sample

4.6.2 Sample Container and Preservation Measurements

The use of proper sample containers is important to ensure that the analytical data collected truly represent site conditions, that the sample volumes are sufficient for analysis, and that the potential for the container itself to contaminate the samples is negligible.

Stainless-steel liners will be supplied by the drilling subcontractor. Prior to sample collection, the stainless-steel liners will be cleaned in accordance with the decontamination procedures described in Section 4.3. Other clean sample containers will be supplied by the laboratory. Sample containers shall remain in storage containers during transport to the sampling location until the time of actual sample collection to avoid the potential introduction of contaminants.

Sample preservation measures will be instituted to prevent or retard the degradation or modification of chemicals and to retard biological activity in samples during transit and storage. Efforts to preserve the integrity of the samples will be initiated at the time of the sampling and will continue until the analyses are performed. Once collected, each sample will be stored in a cooler chilled to 4 degrees Celsius until final transfer to the laboratory.

Table 4-2 presents the sample containers, preservation measures, and holding times specified under the respective analytical method for each parameter.



The following chain-of-custody procedures will be implemented to maintain and document sample possession:

1. Samples will be collected as described in this plan.
2. The Field Operations Manager is personally responsible for the care and custody of the samples until they are properly transferred or dispatched to the analytical laboratory.
3. Labels will be completed for each sample and then affixed to the sample container.
4. Samples will be packaged properly for transfer to the laboratory for analysis.
5. If a sample label is lost during transfer (or if one was never prepared), a written statement will be prepared detailing how the sample was collected and transferred to the laboratory. The statement will include all pertinent information—entries in field log books regarding the sample, whether the sample was in the sample collector's physical possession or in a locked compartment until hand-transported to the laboratory, etc.

4.6.4 Laboratory Custody Procedures

The following procedures will be implemented when the samples arrive at the laboratory:

1. A designated custodian will take custody of all samples upon their arrival at the laboratory. When samples are delivered to the laboratory after hours or when the sample custodian is not present to accept the samples, the samples will be placed in a designated sample area in accordance with the procedures established by the laboratory.
2. The custodian will be responsible for inspecting all samples, labels, and chain-of-custody forms to ensure that the information on each corresponds and that all are completed properly.
3. The custodian will assign a unique laboratory number to each sample and then transfer the samples to secured storage areas. The custodian will then enter the label data into the laboratory's sample tracking system. This system will use the sample label and will ensure that all samples are transferred to the proper analyst or stored in the appropriate secure area.



4.6.3 Field Custody Procedures

To establish the documentation required to trace sample possession from the time of collection to the time of sample analysis and reporting, a chain-of-custody form will be used. The completed chain-of-custody form will accompany every sample to the designated certified laboratory and also through the laboratory during sample analysis. The following information shall be completed on the chain-of-custody form:

- Project name and location
- Project number
- Sample identification
- Date and time samples were collected
- Sample type
- Container type
- Sample preservation measures
- Analyses requested and analytical level
- Signature of sample collector
- Date samples were relinquished
- Signature of person(s) involved in the chain of possession

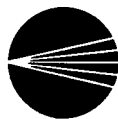


TABLE 4-2
SAMPLE CONTAINERS, PRESERVATIVES, AND HOLDING TIMES

Parameter	Analytical Method	Matrix	Container ^(a)	Sample Volume	Preservation Measure	Holding Time ^(b)
VOCs	EPA 8260	soil	Stainless steel liner	4 oz	Cool, 4°C	14 days
	EPA 8260	water	Borosilicate glass 40ml vial with teflon-lined septum ^(c)	40 ml in duplicate	Cool, 4°C HCL to pH <2 Cool container to 4°C prior to sampling. Store in dark.	14 days
SVOCs	EPA 8270	soil	Stainless steel liner or	4 oz	Cool, 4°C	14 days until extraction; 40 days after extraction
	EPA 8270	water	Amber glass with teflon-lined cap	1 liter	Cool, 4°C Cool container to 4°C prior to sampling. Store in dark.	7 days until extraction; 40 days after extraction
Title 22 Metals ^(d)	EPA 6010	soil	Stainless steel liners	8 oz	Cool, 4°C	6 months
	EPA 6010	water	Polyethylene or glass bottle	100 ml	HNO ₃ to pH <2	6 months
Chromium (VI)	EPA 7196	soil	Stainless steel liners	4 oz	Cool, 4°C	6 months
	EPA 7196	water	Polyethylene or glass bottle	100 ml	No preservatives for Cr ⁺⁶ analysis.	6 months

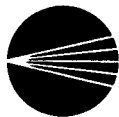


TABLE 4-2
SAMPLE CONTAINERS, PRESERVATIVES, AND HOLDING TIMES
(CONTINUED)

Parameter	Analytical Method	Matrix	Container	Sample Volume	Preservation Measure	Holding Time ^(b)
Mercury	EPA 7471	soil	Stainless steel liners	4 oz	Cool, 4°C	26 days
	EPA 7471	water	Polyethylene or glass bottle	100 ml	HNO ₃ to pH <2	26 days
Pesticides ^(a)	EPA 8080	soil	Stainless steel liners	4 oz	Cool, 4°C	7 days until extraction; 40 days after extraction
	EPA 8080	water	Amber glass with teflon-lined cap	1 liter	Cool, 4°C	7 days until extraction; 40 days after extraction

Notes:

- (a) The volume of containers to be used for all other analysis will depend on the total number of parameters for which the sample in a given container is to be analyzed. This table specifies minimum values.
- (b) Soils submitted for analyses are extracted within 14 days and analyzed within 40 days after extraction. Soils submitted for volatile organic compound analysis are extracted within 24 hours.
- (c) 40ml vials will be filled with zero headspace.
- (d) The metals and pesticides analysis can come out of the same container as the sample volume collected for SVOCs.



4.7 FIELD LOGS

Daily logs will be maintained on site by the Field Operations Manager to provide a daily record of significant events, observations, and measurements during field operations. The daily logs will be maintained in a bound field notebook. All entries will be made legibly in indelible ink, signed, and dated. Field notebooks are intended to provide sufficient data and observations to enable participants to reconstruct the events of the project investigation. The field notebook entries will be factual, detailed, and objective. Information to be recorded in the field notebook includes, but is not limited to, the following:

- Date, time, and place of sampling
- Field QC samples, as applicable
- Weather conditions at the time of sampling, including ambient temperature and approximate wind direction and speed
- Data from field analyses (pH, water-level measurements, etc.)
- Observations about the site and samples (odors, appearance, etc.)
- Information about any extraneous activities that may affect the integrity of the samples (e.g., emissions from nearby operations)
- Analyses and required preservation techniques
- Sample cooler temperature readings

In addition to the field notebook, the Field Operations Manager shall maintain Daily Field Measurement Record.

4.7.1 Daily Field Measurement Records

The Daily Field Measurement Record will be used to record field measurements collected during sampling. At a minimum, the following information will be included in the record:

- Project name and number
- Date



- For subsurface soil samples:
 - Location and depth where the sample was collected
 - Time when the sample was collected
 - The length of the split-spoon sampler barrel used to penetrate the soil
- For groundwater samples:
 - Identification number of the well for which data is being measured
 - Time when the sample was collected
 - Water level, conductivity, temperature, pH, and sample headspace PID reading

4.7.2 Corrections to Documentation

If an error is made on any of the daily activity log entries, the individual who signed the document will make corrections by crossing out the error with a single line and then entering the correct information. The erroneous information should not be obliterated. All corrections will be initialed and dated.

4.7.3 Disposition of Documentation

Boeing will receive all copies of all information contained in the project file upon completion of the field effort. Field documentation will be clearly labeled and placed in the project files for no fewer than five years. Project files may be destroyed after that time provided Boeing is notified at least six months before the documents are to be destroyed.

4.7.4 Laboratory Files

Laboratory files will be maintained for the C-6 facility groundwater investigation project. Copies of all information in the project file will be submitted to Boeing. The project file will contain all data, records, and reports documenting all laboratory handling and analysis, including raw data calculation sheets, chromatograms, and mass spectrums, in both electronic and hard copy formats. All written and electronic records will be maintained as part of the project file for no fewer than five years. Project files may be destroyed after that time provided Boeing is notified at least six months before the documents are to be destroyed.



5. REPORTING AND SCHEDULE

The anticipated task/reporting schedule for well installation and the initial sampling is presented in Table 5-1 below.

TABLE 5-1
TASK AND REPORTING SCHEDULE

DATE	TASK/REPORTS
December 7, 1998	Issue Request for Proposal (RFP)
January 8, 1999	Award Contract on RFP
January 25 - February 5, 1998	Conduct Groundwater Characterization
February 29, 1998	Submit Draft Groundwater Characterization Report

All permanent groundwater wells will be sampled on a quarterly basis. This SAP does not address such sampling.



6. REFERENCES

Integrated Environmental Services, Inc. (IESI) 1998a. *Draft Offsite Groundwater Characterization Workplan, Lockheed Martin Corporation Former International Light Metals (ILM) Facility Los Angeles, California (EPA ID No. CAD030398622)*. Prepared for Boeing Realty Corporation. August.

Integrated Environmental Services, Inc. (IESI) 1998b. *Parcel B Supplemental Site Investigation Report, Boeing C-6 Facility, Los Angeles, California*. Prepared for Boeing Realty Corporation, July.

Kennedy/Jenks Consultants (K/J) 1997a. *Groundwater Monitoring Data Summary Report, First Quarter 1997, McDonnell Douglas Realty Company C-6 Facility, Los Angeles, California*. Prepared for McDonnell Douglas Realty Company.

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Richard C. Slade and Associates (RSC) 1998a. *Workplan for Destruction of Two Water-Supply Wells, Boeing Realty Corporation C-6 Facility, Los Angeles, California*. Prepared for Boeing Realty Corporation. June.

Richard C. Slade and Associates (RSC) 1998b. *Summary of Operations, Destruction of Two Water-Supply Wells, Boeing Realty Corporation C-6 Facility, Los Angeles, California*. Prepared for Boeing Realty Corporation. September.